Check List the journal of biodiversity data

NOTES ON GEOGRAPHIC DISTRIBUTION

Check List 14 (6): 977–984
https://doi.org/10.15560/14.6.977

PENSOFT

New altitudinal distribution record and updated geographic distribution of the freshwater crab *Trichodactylus fluviatilis* Latreille, 1828 (Crustacea, Trichodactylidae)

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Abstract

The freshwater crab *Trichodactylus fluviatilis* Latreille, 1828 is recorded here for the first time, at an altitude above 1000 m a.s.l. Sampling was performed in the Grota stream in Campos das Vertentes, Minas Gerais state, Brazil. This new record extends the known altitudinal distribution to 1115 m a.s.l., which significantly contributes to understanding the conditioning limits and factors for this species' distribution. Moreover, the occurrence of an ectosymbiont platyhelminth of the genus *Temnocephala* is also reported on the crabs collected.

Key words

Brachyura; Alto Paraná ecoregion; High altitude streams; Atlantic Forest.

Academic editor: Murilo Zanetti Marochi | Received 3 April 2018 | Accepted 5 August 2018 | Published 2 November 2018

Citation: Brito-Fonseca VLG de, Alencar CERD, Moraes SASN, Vale VF, Freire FAM (2018) New altitudinal distribution record and updated geographic distribution of the freshwater crab *Trichodactylus fluviatilis* Latreille, 1828 (Crustacea, Trichodactylidae). Check List 14 (5): 977–984. https://doi.org/10.15560/14.6.977

Introduction

Freshwater crabs are classified in Potamoidea Ortmann, 1896, which is represented in the Americas by the families Pseudothelphusidae Ortmann, 1893 and Trichodactylidae H. Milne-Edwards, 1853 (Magalhães 2003). The Trichodactylidae are composed of 15 genera (Magalhães and Türkay 1996), which together encompass about 51 species of exclusively freshwater crabs (Yeo et al. 2008); 29 species are recorded in Brazil. Members of the Trichodactylidae occur in rivers that are part of the Atlantic drainage basins from southern Mexico to Argentina, (Magalhães 2003). In Brazil, members of this family can be found in all hydrographic basins in the country (Magalhães 2003), including those basins with intermittent rivers in the northeastern semiarid region (Freita et al. 2013).

Trichodactylus fluviatilis Latreille, 1828 is distributed in the coastal basins of the Brazilian states of Pernambuco, Alagoas, Sergipe, Bahia, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Paraná, Santa Catarina, and Rio Grande do Sul, coinciding with the original extent of the Atlantic Forest and with the limits of the Alto Paraná river basin (Magalhães 2003). This species is found on and between rocks, on muddy bottoms, and among decaying leaves of mountainous rivers, streams, and waterfalls (Mossolim and Mantellato 2008).

Trichodactylus fluviatilis is an important component

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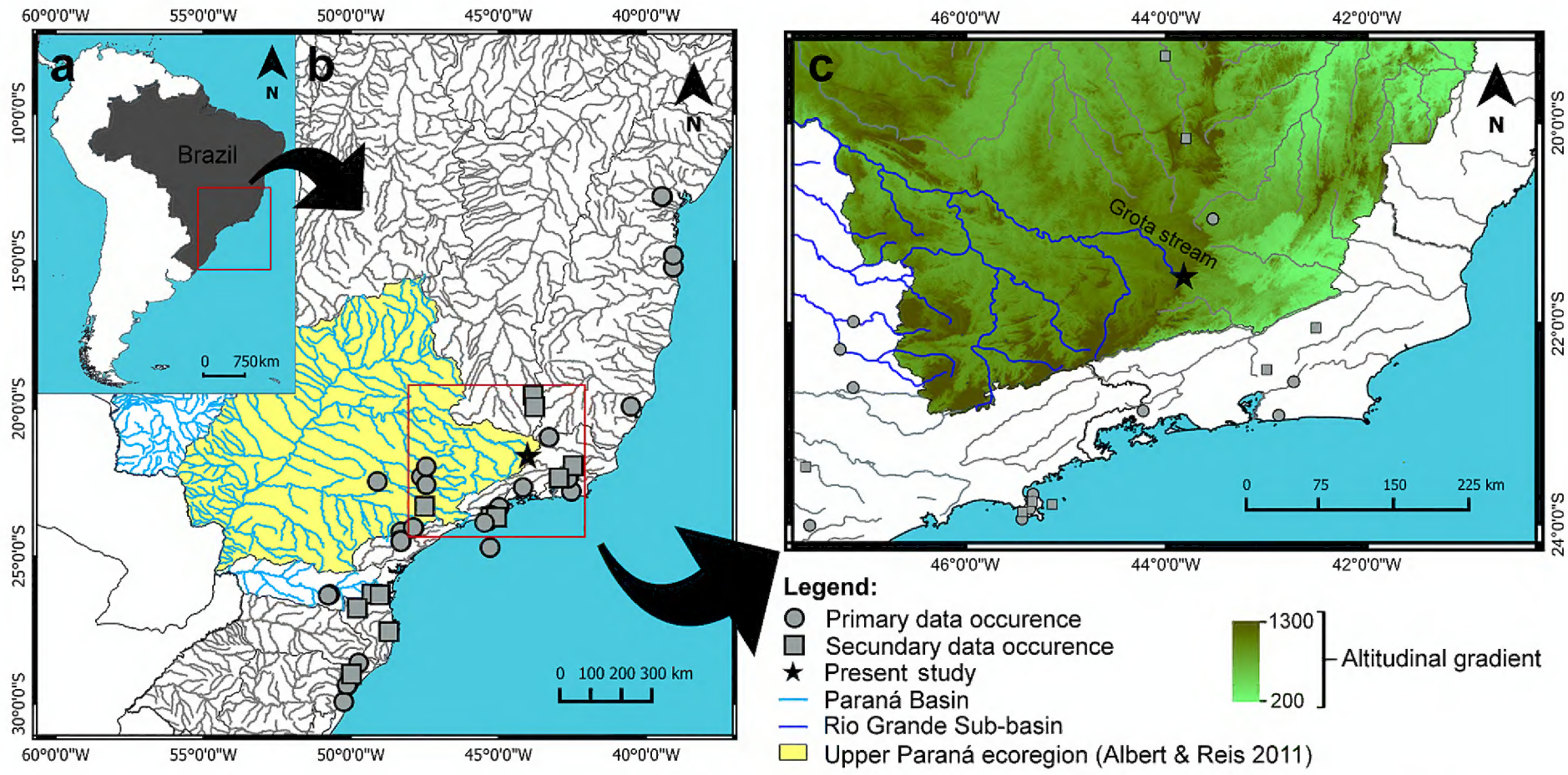

Figure 1. Distribution of *Trichodactylus fluviatilis* Latreille, 1828 in Brazil. **A, B.** Distribution based on literature review and GBIF data. **C.** Altitudinal gradient of Minas Gerais, Southeastern region, Brazil. Highlighting the Rio Grande Sub-basin. Circle = primary data occurrence, square = secondary data occurrence, star = new altitudinal record.

of the aquatic freshwater ecosystem trophic chain by processing organic matter and preying on small invertebrates. It is an important food resource for fish species and other animals (Magalhães 2003), and within its geographic range it serves as food for small, riverside communities of humans (Neto 2007). Despite the importance of *T. fluviatilis*, studies of its biology and ecology are scarce, as is occurrence and distributional data. Therefore, we report new data on this species' altitudinal range in the Rio Grande hydrographic basin and an ectosymbiotic relationship with a temnocephalian platyhelminth of the genus *Temnocephala* Blanchard, 1849. We also present an up-to-date geographic distribution for this species.

Methods

The Rio Grande Sub Hydrographic Basin (RGSHB) is located in southeastern Brazil, and more precisely in the Paraná Hydrographic Region. The RGSHB is part of the Alto Paraná Hydrographic Ecoregion (sensu Abell et al. 2008) and is divided into 8 segments (IPT 2008): Upper Rio Grande, Jacaré, Furnas reservoir, Verde river, Sapucaí, Mogi-Guaçú e Pardo river, Middle Rio Grande, Lower Rio Grande, and Mortes river. The Grota stream, the site of our new record of *T. fluviatilis*, is at the hydrographic division of the Rio das Mortes and Campos das Vertentes mesoregion. The Grota stream is a tributary of the Rio Grande. The main towns in the RGSHB are São João Del Rey, Barbacena, Oliveira, and Campo Belo, which encompass about 30 municipalities, including Santa Rita do Ibitipoca (IGAM 2010).

We collected *T. fluviatilis* individuals in Grota stream, a high-altitude watercourse with an average depth of 70 cm. The collection site in the stream was approximately 2 km from the stream's headwater source and in a remnant strip of Atlantic Forest (Fig. 1). The altitude was recorded using a Garmin 76CSx GPS receiver.

Sampling was executed at night for 3 hours in each field trip in January 2013 and 2014, during the crescent moon phase, and establishes a capture effort based on "AquaRAP" procedure (Rapid Assessment Protocol in Aquatic Systems; Alonso and Willink 2011) using an active search, handnet, and the artisanal fishing tool known as the "parão". The "parão" is a bamboo stick with a ball of bait placed at its tip. Sampling using a "parão" was done in 2 steps: (1) a "parão" with bait (poultry viscera) was placed in possible microhabitats of *T. fluviatilis* occurrence, based on experience and literature information; then (2) the collector (VGL Brito) promoted water turbidity by suspending the upstream bottom sediment, forcing animals to leave their shelter.

Collected individuals were fixed with 100% ethanol and stored at low temperature (–20 °C). In laboratory, specimens were identified based on taxonomic criteria proposed by Magalhães (2003) and Melo (2003) and sexed using abdomen morphology observation (triangular for males and rounded for females), as well as gonopod presence for males or 4 pairs of pleopods for females. Carapace width (CW) of the crabs was measured using a 0.01 mm precision caliper. Each individual was further inspected for the presence of ectosymbionts. Ectosymbionts were identified as being from the genus *Temnocephala* Blanchard, 1849, based on the generic description used in Damborenea and Cannon (2001) and Amato et al. (2005). Individuals and eggs of *Temnocephala* adhered to *T. fluviatilis* body were photographed.

Animals and their respective ectosymbionts were stored in the Grupo de Estudos em Ecologia e Fisiologia de Animais Aquáticos invertebrate collection of the Federal University of Rio Grande do Norte (GEEFAA/UFRN) and

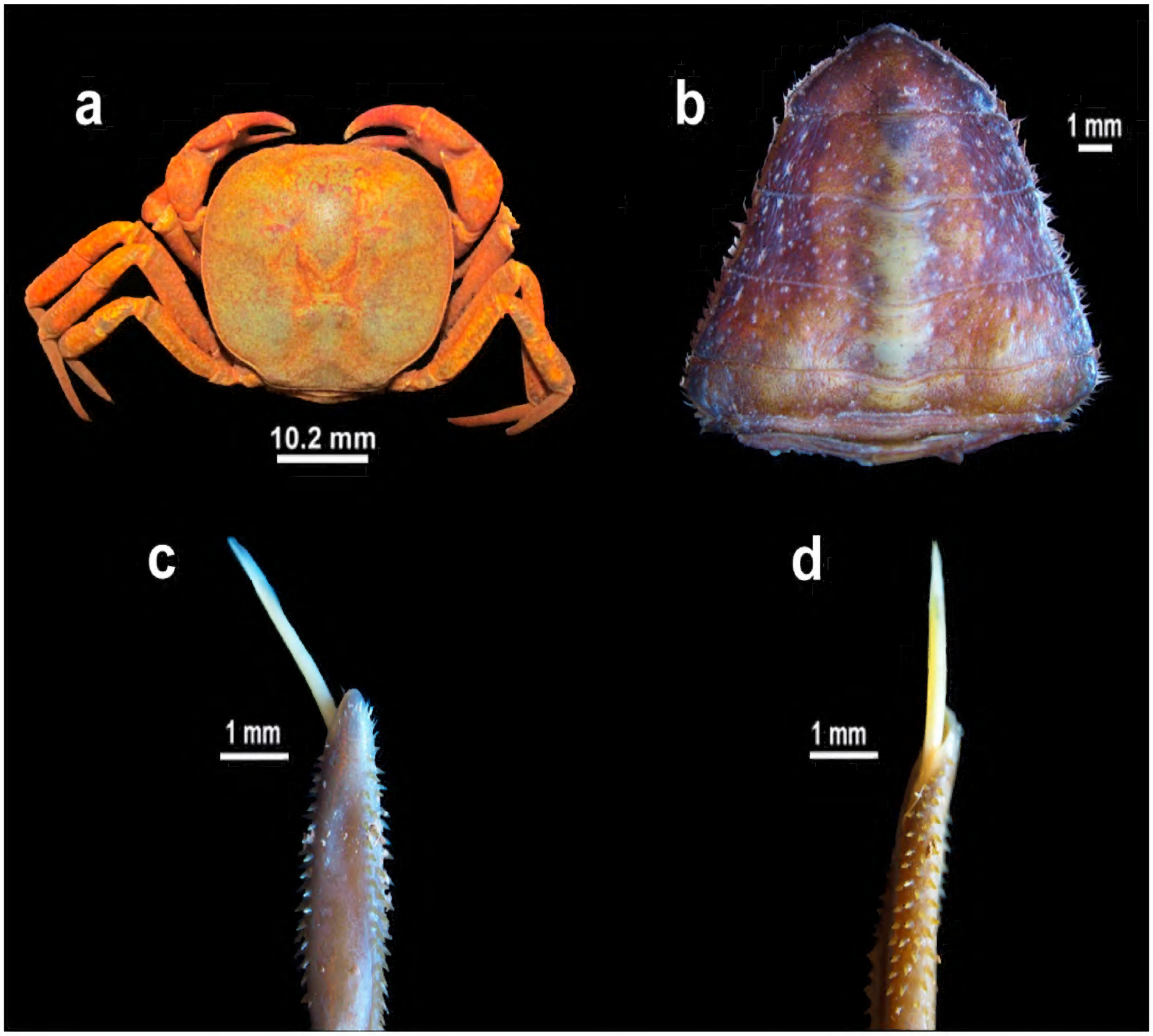

Figure 2. *Trichodactylus fluviatilis* Latreille, 1828. **a.** General view of female specimen. **b.** male abdomen. **c.** first gonopodium lateral view. **d.** first gonopodium mesioventral view.

in the National Institute of Amazon Research (INPA).

A review of occurrences of *T. fluviatilis* was made using geographic coordinate data from 2 sources. The first was a specialized literature review, and the second was based on material deposited in scientific collections and museums, accessed via the Global Biodiversity Information Facility (GBIF 2013) and Species Link (http://splink.cria.org.br/). Records that showed some inconsistency in the data (e.g. a taxonomic mismatch, invalid geographic coordinates, a lack of data about the record and its respective institution) were discarded. Lastly, in the case of occurrences that lacked geographic coordinates but had otherwise satisfactory details, the geographic coordinates were estimated using Google Earth Pro® v. 7.1.2.2041. The institutions consulted using GBIF were: the Museum of Comparative Zoology (MCZ), Harvard University; Zoologisches Museum (ZMB), Humboldt Universität; Senckenberg Museum (SMF); the National Museum of Natural History (USNM); and the Field Museum (FMNH).

All data (primary = this study and secondary = literature, GBIF and SpeciesLink, accessed on 4 March 2014) were compiled and inserted in a geospatial database, carefully discriminating the source of the record. Records that lacked altitude information had their values provided using the altitude shapefile from the Geoprocessing Laboratory of the Federal University of Rio Grande do Sul (https://www.ufrgs.br/labgeo/). In cases of incomplete locality description and/or lacking geographic coordinates, the altitudinal values were estimated based on watercourse total amplitude, extracted by us for each locality, using the altitude shapefile.

Subsequently, the resulting data were imported into a geographic information system via QuantumMap v. 2.4.0 software (QGIS Development Team 2004) using the WGS84 datum. The hydrographic ecoregion delimitation proposed by Abell et al. (2008) was added to the GIS, after being obtained from the Freshwater Ecoregions of the World (http://www.feow.org), and an altitudinal gradient, gathered from the Geoprocessing Laboratory of the Federal University of Rio Grande do Sul (https://www.

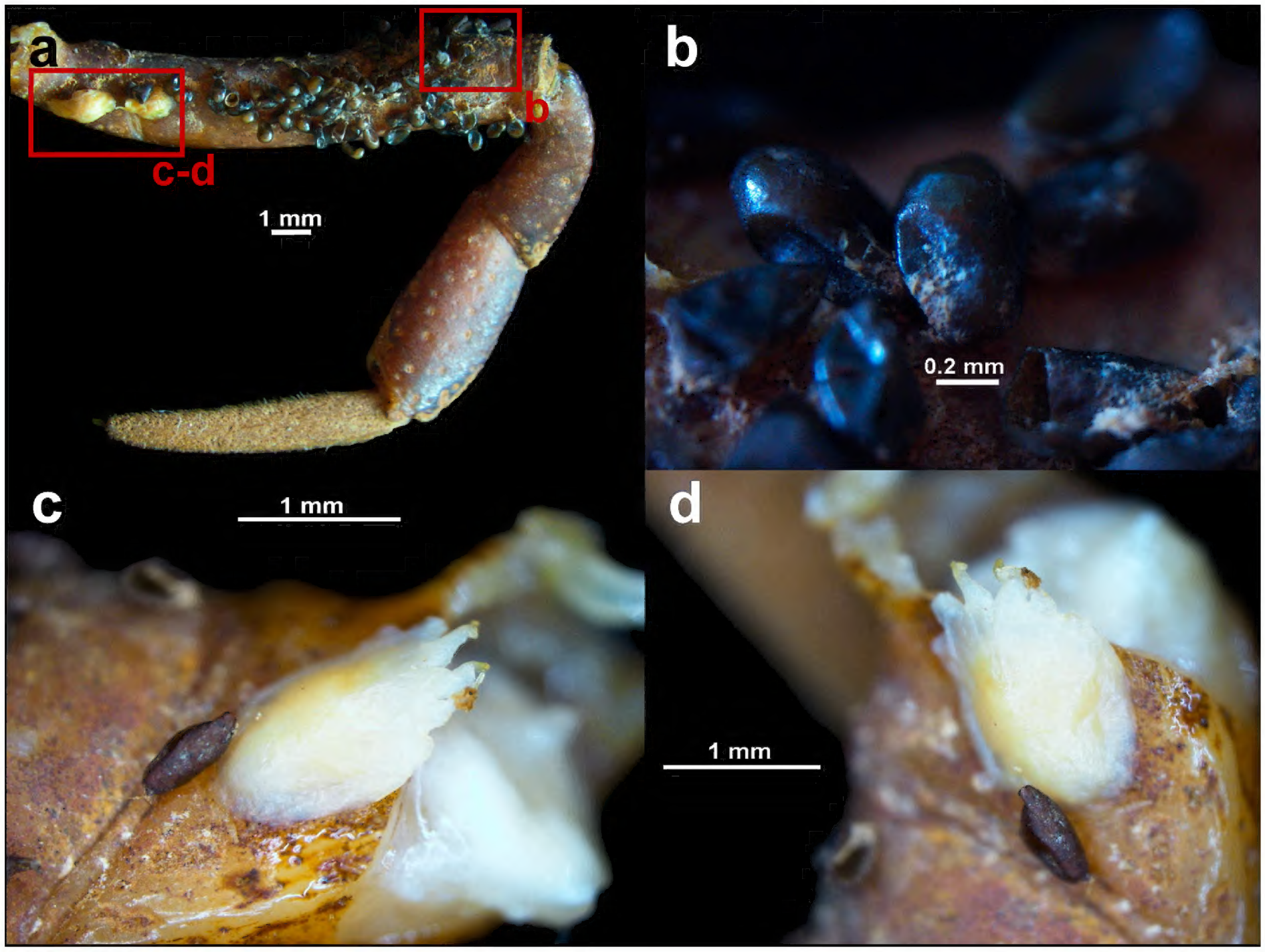

Figure 3. *Trichodactylus fluviatilis* Latreille,1828. **a.** Fifth pereiopod with *Temnocephala* sp. Eggs. **b.** *Temnocephala* sp. eggs in detail. **c, d.** adult individuals of *Temnocephala* sp.

ufrgs.br/labgeo/).

Results

Order Decapoda Latreille, 1802

Infraorder Brachyura Linnaeus, 1758
Family Trichodactylidae H. Milne-Edwards, 1853
Genus *Trichodactylus* Latreille, 1828

***Trichodactylus fluviatilis* Latreille, 1828**
Figure 2

Examined material. Brazil: Minas Gerais: Rio Grande sub-basin, municipality of Santa Rita do Ibitipoca, Grota stream, stretch upstream from a small waterfall (21°35′46.85″ S, 044° 01′09.80″ W, 1115 m elev.), coll. by Brito-Fonseca VLG, 14 January 2014 (2 ♀ (CW = 24.6 mm and 27.1 mm), INPA-2145; 1 ♂ (CW = 25.6 mm), GEEFAA/UFRN-360).

Diagnosis. Sub-square shape, slightly inflated, and convex carapace (Fig. 2a). Frontal, slightly inclined downwards; frontal and anterolateral border smooth (Fig. 2a). Male abdomen subtriangular, proximal border of sixth somite with width similar to telson proximal border (Fig. 2b). Straight gonopodium with a moderately accentuated median constriction; discontinuous field of spines, displayed in 2 subequal areas on lateroventral and mesodorsal surface; symmetrical border apex rounded and slightly angled (Fig. 2c, d) (Magalhães 2003).

Additional observations. Our specimens of *T. fluviatilis* individuals had adult individuals (Fig. 3a) and eggs (Fig. 3b) of the ectosymbiont platyhelminthes *Temnocephala* on the pereiopods and along the mero extension (Fig. 3c, d). Species of Trichodactylidae, including *T. fluviatilis*, have been reported as host species of *Temnocephala* (Amato et al. 2005, 2006, Azevedo-Santos and Lima-Stripari 2010).

Based on altitudinal data, *T. fluviatilis* showed an altitudinal distribution from sea level (0 m) to 879 m. Animals that we collected in January 2014 were the first found above 1000 m a.s.l. (Table 1, Appendix Table A1).

The consulted database from GBIF had 50 records of *T. fluviatilis* for Brazil. However, only 3 records had geographic coordinates. Using locality description, it was possible to estimate 14 geographic coordinates accurately (Table 1). Two registered localities from GBIF were removed from the final map, as they were placed in the Amazon, which does not corroborate the species' geographic distribution (sensu Magalhães 2003) and, possibly, are specimens that require taxonomic review. On the SpeciesLink database, no record of this species

was found. Therefore, using primary and secondary data, the updated geographic distribution of this species extends from Bahia to Rio Grande do Sul states, encompassing Espírito Santo, Rio de Janeiro, Minas Gerais, São Paulo, and Santa Catarina states (Fig. 1, Table 1, S1).

Discussion

Trichodactylus fluviatilis specimens were collected in a seasonal period characterized by having the highest concentration of rain (November to January; Melo et al. 2007). In region where our study was located, precipitation oscillates between 260 mm and 280 mm (Melo et al. 2007) and water temperature between 18 °C and 20 °C (VGLBF pers. observ.). Meanwhile, in the dry season, the rain level in this region shows a precipitation rate below 5 mm (IGAM 2014). In field observations, the number of sightings increased as local precipitation increased throughout an annual cycle. During field trips in a period of lesser rain intensity (February to October), no individuals of *T. fluviatilis* were seen.

Most trichodactylid crabs that occur in Brazil inhabit rivers on plains that do not exceed elevations of 300 m (Magalhães 1999). However, recent surveys have updated the altitudinal limits of *Trichodactylus* throughout its known geographic distribution. Recently, specimens of *T. fluviatilis* and *T. petropolitanus* were found in Serra da Paranapiacaba (São Paulo state) at elevations above 500 m (Rocha and Bueno 2004). Rocha and Bueno did not specify the upper altitude limit of their records, but according to their sampling data and by estimating elevation using satellite imagery, individuals were captured at altitudes reaching approximately 500 m a.s.l. Rocha and Bueno (2011) recorded the occurrence of *T. fluviatilis* at about 580 m a.s.l. (estimated, using satellite imagery) in Jacupiranga State Park, southern São Paulo state. Gomides et al. (2009) recorded *T. fluviatilis* at 770 m a.s.l. in Santa Cândida Municipal Biological Reserve, which is located in Juiz de Fora municipality, Minas Gerais state, southeastern Brazil.

These animals have the capacity to complement their life cycle outside of the marine environment (Rocha and Bueno 2004), and it is a significant advantage to be able to inhabit continental waters, including river headwaters at high altitudes. In finding *T. fluviatilis* at 1115 m a.s.l., we extending the species' altitudinal range limit by over 200 m.

New occurrence and altitudinal data, such as documented here, contributes to the faunal knowledge; it can assist in studies on evolutionary, biogeographic, and aquatic resource conservation.

Acknowledgements

The authors express their gratitude for the scholarship offered (Carlos ERD Alencar and Sávio ASN Moraes – CAPES/Brazil). They also thank Prof. Célio Ubirajara Magalhães Filho (Instituto Nacional de Pesquisas da Amazônia/INPA) for the confirmation of species identification and the Grupo de Estudos em Ecologia e Fisiologia de Animais Aquáticos/GEEFAA for laboratorial support. We are also thankful to the administration of Candonga farm for authorizing our research activities and for logistical support. Thanks are due to IBAMA for approving our sampling license (SISBIO/ICMBIO 28314-1) and to a local fisherman, Alex Krambeck Fonseca for his assistance with sampling. All collections were done according to federal and state laws. The authors declare that there are no conflicts of interest.

Authors' Contributions

VLGBF wrote the text, conducted the online database review and took animal photographs; CERDA wrote the text, identified specimens, conducted the literature review and revised the text; SASNM performed the lit-

Table 1. Occurrence reports of *Trichodactylus fluviatilis* Latreille, 1828 available in GBIF. For collection codes, see Methods. GC Estimated, Geographic coordinate estimate (logic, Y-Yes/N-No).

GBIF id no.	Catalog no.	Collection code	Institution code	Latitude (S)	Longitude (W)	State	Locality	Geographic coordinates estimated
699120163	CRU-6376	IZ	MCZ	03°20′46″	064°45′03″	Amazonas*	Tefé	Y
889225304	2781462216	IZ	USNM	04°11′56″	063°34′27″	Amazonas*	Urucu River 400 km from Manaus	Y
699120164	CRU-4934	IZ	MCZ	19°37′60″	043°53′30″	Minas Gerais	Santo Lagoon	N
699120144	CRU-4936	IZ	MCZ	20°01′60″	043°49′60″	Minas Gerais	Macacos River (tributary of Velhas River)	N
699120145	CRU-4935	IZ	MCZ	22°02′48″	042°30′52″	Rio de Janeiro	Small tributary of Negro River	Y
208074995	4503	CC	SMF	22°27′40″	043°00′01″	Rio de Janeiro	Serra dos Órgãos	Y
667825150	3660	IZ	FMNH	23°25′44″	047°35′36″	São Paulo	Freshater lagoon in Ipanema farm	Y
699110231	CRU-8399	IZ	MCZ	23°47′34″	045°20′25″	São Paulo	São Sebastião Island	Y
208074992	2492	CC	SMF	23°48′14″	045°08′25″	São Paulo	Búzios Island	Y
251629458	21540	CC	ZMB	26°25′40″	049°23′38″	Santa Catarina	Novo River	Y
208074979	4321	CC	SMF	26°27′15″	049°06′38″	Santa Catarina	Itapucu River, Jaguará do Sul	Y
251629453	8411	CC	ZMB	26°54′00″	049°04′60″	Santa Catarina	Blumenal	N
251629457	15798	CC	ZMB	27°42′40″	048°49′10″	Santa Catarina	Teresópolis	Y
208074996	5367	CC	SMF	29°09′59″	050°05′48″	Santa Catarina	Itaimbezinho	Y

*Doubtful records according to geographic distribution by Magalhães (2003).

erature review, made the geographic distribution maps and revised the text; VFV performed the literature review and online database review, wrote the text and revised the text; FAMF wrote and revised the text.

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Appendix

Table A1. *Trichodactylus fluviatilis* (Latreille, 1828). Compilation of secondary data of occurrence in literature. Information: authors of publication (year), locality (municipality), 2nd order hydrographic basin, higher geography, presence of ectoparasites, altitude (m) and geographical coordinates (degrees, minutes and seconds, available).

Source	Locality (municipality)	2nd order hydrographic basin	State	Ectoparasites	Altitude (m)	Geographic coordinates
Amato et al. (2005)	Arroio Água Parada (Maquiné)	Maquiné basin	Rio Grande do Sul	*Temnocephala trapeziformis*	200*	29°66'20"S, 050°21'15"W
	Arroio Carvão (Maquiné)	Maquiné basin	Rio Grande do Sul	*Temnocephala trapeziformis*	190*	29°32'29"S, 050°13'49"W
	Arroio Forqueta (Maquiné)	Maquiné basin	Rio Grande do Sul	*Temnocephala trapeziformis*	120*	29°32'17"S, 050°14'44"W
	Trutas Valley, Antas river headwaters (São José dos Ausentes)	Taquari-Antas river basin	Rio Grande do Sul	*Temnocephala trapeziformis*	200*	28°47'00"S, 049°50'53"W

Table A1. *Continued.*

Source	Locality (municipality)	2nd order hydrographic basin	State	Ectoparasites	Altitude (m)	Geographic coordinates
Almeida et al. (2008)	Small stream unnamed, Palha mountain range (Coaraci)	Santana river basin	Bahia	NA	300*	NA
	Ribeirão Serafim, Tranquilidade (Ilhéus)			NA	60*	14°51'18"S, 039°06'04"W
	Small stream unnamed, CEPLAC Ecologic Station (Una)			NA	30*	15°15'59"S, 039°06'06"W
	Água Preta river (Itaju do Colônia)			NA	200*	NA
	Meio river (Itororó)			NA	250*	NA
	Cachoeira river (Itabuna)			NA	50*	NA
	Unnamed, Fazenda Unacav (Buerarema, nowadays São José da Vitória)			NA	200*	NA
	CEPLAC Ecologic Station (Ilhéus)			NA	20*	NA
	Almada river (Ilhéus)			NA	0*	NA
	Unnamed, Quatro Irmãos Farm (Ilhéus-Uruçuca)			NA	45*	NA
	Unnamed, Serrapilheira Farm (Ilhéus)			NA	75*	NA
Azevedo et al. (2012)	Mato Grosso river Sub basin (Saquarema)	Saquarema river basin	Rio de Janeiro	NA	40	22°55'00"S, 042°35'00"W
Boos et al. (2012)	Espinguarda River, Serra do Itajaí National Park (Indiaial)	Southeast basins	Santa Catarina	NA	NA	NA
	Vananal' River (presumably 'Bananal')			NA	NA	NA
	Cubatão river (Águas Mornas)			NA	NA	NA
	Lauro Muller (Novo Horizonte)			NA	210*	NA
	Unnamed (São Francisco do Sul)			NA	15*	NA
	Unnamed (Joinville)			NA	10*	NA
	Humboldt river (Corupá)			NA	70*	NA
	Troncos river (Joinville)			NA	70*	NA
	Unnamed (Jaraguá do Sul)			NA	30*	NA
	Itapocú River			NA	NA	NA
	Unnamed (Blumenau)			NA	20*	NA
	Cedros river (Alto Palmeiras)			NA	NA	NA
	Unnamed (Timbé do Sul)			NA	120*	NA
	Timbé 'road to' (Joinville)			NA	10*	26°12'30"S, 048°50'47"W
	Juvenato mountain (Jaraguá do Su)			NA	NA	NA
	Araranguá river (Nova Veneza)			NA	10*	28°40'41"S, 049°36'24"W
Chagas et al. (2009)	Cabeça river (Rio Claro)	Corumbataí basin	São Paulo	NA	500*	22°24'35"S, 047°39'27"W
	Passa Cinco river (Rio Ipeúna)			NA	500*	22°25'08"S, 047°42'48"W
	Ribeirão Claro, State Forest Garden Edmundo Navarro de Andrade (Rio Claro)			NA	580*	22°41'35"S, 047°32'26"W
Costa et al. (2016)	Macuco stream (Santa Leopoldina)	Iguaçú river basin	Espírito Santo	NA	593	20°01'24"S, 040°33'01"W
Costa Neto (2007)	Velha Eugênia stream (Santa Terezinha)	Jacutinga basin	Bahia	NA	839	12°51'00"S, 039°28'00"W
Franchi et al. (2011)	Ribeirão Claro river	Corumbataí basin	São Paulo	NA	580*	22°41'35"S, 047°32'26"W
Gomides et al. (2009)	Santa Cândida Municipal Biologic Reserve (Santa Cândida)	Paraibuna river basin	Minas Gerais	NA	770	21°41'20"S, 043°20'40"W
Lima et al. (2012)	Pluvial water body (Ubatuba)	Independent	São Paulo	NA	50*	23°27'22"S, 045°03'00"W
Mossolin & Mantelatto (2008)	Ponta das Canas (São Sebastião)	Camburi river basin	São Paulo	NA	20**	23°43'43"S, 45°20'38"W
	Toca waterfall (São Sebastião)			NA		23°49'35"S, 45°20'30"W
	Green Park (São Sebastião)			NA		23°49'42"S, 45°20'51"W
	Pedra well (São Sebastião)			NA		23°50'26"S, 45°21'34"W
	Veloso waterfall (São Sebastião)			NA		23°53'04"S, 45°25'53"W
	Frades Harbor (São Sebastião)			NA		23°55'45"S, 45°26'34"W
	Vista waterfall (São Sebastião)	Camburi river basin	São Paulo	NA		23°53'04"S, 45°25'53"W
	Marambaia (São Sebastião)			NA		23°56'04"S, 45°25'52"W
	Escada well (São Sebastião)			NA		23°50'30"S, 45°21'33"W
	Ramalho stream (São Sebastião)			NA		24°50'31"S, 45°21'35"W
Pescinelli et al. (2014)	Barreiro river (Paulistânia)	Paraná river basin	São Paulo	NA	560	22°34'42"S, 49°11'92"W
Rocha & Bueno (2004)	Carmo river, Intervales State Park (Iporanga)	Ribeira de Iguape basin	São Paulo	NA	500**	24°18'25"S, 48°24'52"W
	Ostras river, Jacupiranga State Park (Eldorado)			NA		24°38'16"S, 48°24'05"W
	Preto river, Carlos Botelho State Park (Sete Barbas)			NA		24°10'18"S, 47°57'42"W
	Água Parada river, Carlos Botelho State Park (Sete Barbas)			NA		24°09'26"S, 47°58'53"W

Table A1. *Continued.*

Source	Locality (municipality)	2nd order hydrographic basin	State	Ectoparasites	Alti-tude (m)	Geographic coordinates
Rocha & Bueno (2011)	Ostras river, Jacupiranga State Park (Eldorado)	Ribeira de Iguape basin	São Paulo	NA	260*	24°38'16"S, 48°24'05"W
				NA	100*	24°36'01"S, 48°23'36"W
	Unnamed river, Jacupiranga State Park (Jacupiranga)			NA	500*	24°38'09"S, 48°24'18"W
				NA	500*	24°37'59"S, 48°24'18"W
	Arrivá river, Jacupiranga State Park (Jacupiranga)			NA	560*	24°38'09"S, 48°24'33"W
	Unnamed river, Jacupiranga State Park (Jacupiranga)			NA	580*	24°38'23"S, 48°24'40"W
Segadilha & Silva-Soares (2015)	Piraí river (Rio Claro)	Piraí river basin	Rio de Janeiro	NA	660	22°46'54"S, 44°13'56"W
Silva et al. (2014)	Velha Eugênea stream (Santa Terezinha)	Jacutinga basin	Bahia	NA	400**	12°50'43"S, 39°29'46"W
Silva-Junior et al. (2017)	Guapiaçu river tributary (Cachoeiras de Macacu)	Guapi-Macacu basin	Rio de Janeiro	NA	190	22°24'56"S, 42°44'16"W
				NA	148	22°25'17"S, 42°44'20"W
				NA	168	22°25'03"S, 42°44'15"W
				NA	192	22°26'07"S, 42°42'56"W
				NA	185	22°26'40"S, 42°42'22"W
				NA	200	22°26'40"S, 42°42'21"W
				NA	195	22°27'24"S, 42°40'55"W
				NA	120	22°28'01"S, 42°41'32"W
				NA	90	22°28'16"S, 42°41'46"W
Werley & Basilio (2008)	Bonito river tributary (Porto União)	Iguaçú river basin	Santa Catarina	NA	774-879	26°26'13"S, 50°49'59"W
				NA		26°26'30"S, 50°50'00"W
				NA		26°26'49"S, 50°51'00"W
				NA		26°27'11"S, 50°51'46"W
				NA		26°27'47"S, 50°53'17"W
				NA		26°27'52"S, 50°53'11"W
Present study	Grota stream (Santa Rita do Ibitipoca)	Rio Grande basin	Minas Gerais	*Temnocephala* sp.	1115	21°35'47"S, 44°01'10"W

NA - Not available; * Altitude estimated by altitude shapefile provided by LABGEO-UFRGS (see Material and Methods Section for further details); ** Altitude estimated by appoximated locality informed by the respective authors. Present study and new altitude record bold highlighted.